

Table 4.8. Recommended Stormwater Criteria for Design Manuals

CRITERION #4: STABLE ENVIRONMENTAL CONVEYANCE (SEC) – Convey Stormwater to Protect Downstream Channels

Explanation	<p>The stormwater system should be designed so that increased post-development discharges that are NOT mitigated through application of Criteria #1 through #3 will not erode natural channels or steep slopes. This will protect in-stream habitats and reduce in-channel erosion. Conveyance systems can be designed to reduce stormwater volume, create non-erosive velocities, incorporate native vegetation, and, in some cases, restore existing channels that are degraded.</p> <p>This design process involves careful analysis of the downstream system – beginning with the site's position within a watershed or drainage area. First, compare the size of the on-site drainage area <u>at each of the site's discharge points</u> to the total drainage area of the receiving channel or waterway. Note that the point of analysis may not always be the property boundary of the site, but the point where the site's discharge joins a natural drainage swale, channel, stream, or waterbody.</p> <p>The recommended standard below presents a tiered system for SEC compliance based on the site/drainage area analysis discussed above.</p>
Recommended Standards	<p>At each discharge point from the site, if the on-site drainage area is LESS than 10% of the total contributing drainage area to the receiving channel or waterbody, then the following Tier 1 performance standards shall apply:</p> <p><u>Tier 1 Performance Standards</u></p> <ul style="list-style-type: none">▪ Wherever practical, maintain sheetflow to riparian buffers or vegetated filter strips. Vegetation buffers or filter strips shall be preserved or restored where existing conditions do not include dense vegetation (or adequately sized rock in arid climates).▪ Energy dissipators and level spreaders shall be used to spread flow at outfalls▪ On-site conveyances shall be designed to reduce velocity through a combination of sizing, vegetation, check dams, and filtering media (e.g., sand) in the channel bottom and sides▪ If flows cannot be converted to sheetflow, they shall be discharged at an elevation that will not cause erosion or require discharge across any constructed slope or natural steep slopes.▪ Outfall velocities shall be non-erosive from the point of discharge to the receiving channel or waterbody where the discharge point is calculated. <p>At each discharge point from the site, if the on-site drainage area is GREATER than 10% of the total contributing drainage area to the receiving channel or waterbody, then the Tier 1 performance standards shall apply PLUS the following Tier 2 performance standards:</p> <p><u>Tier 2 Performance Standards</u></p> <ul style="list-style-type: none">▪ Sites greater than 10 acres (or a site size deemed appropriate by the local program) shall perform a detailed downstream (hydrologic and hydraulic) analysis based on post-development discharges. The downstream analysis shall extend to the point where post-development discharges have no significant impact (and do not create erosive conditions) on receiving channels, waterbodies, or storm sewer systems.▪ If the downstream analysis confirms that post-development discharges will have an impact on receiving channels, waterbodies, or storm sewer

Table 4.8. Recommended Stormwater Criteria for Design Manuals

CRITERION #4: STABLE ENVIRONMENTAL CONVEYANCE (SEC) – Convey Stormwater to Protect Downstream Channels	
	<p>systems, then the site shall incorporate some or all of the following to mitigate downstream impacts:</p> <ol style="list-style-type: none">(1) Site design techniques that decrease runoff volumes and peak flows.(2) Downstream stream restoration or channel stabilization techniques, as permitted through local, state, and federal agencies.(3) 24-hour detention of the volume from post-development 1-year, 24-hour storm (the volume is stored and gradually released over a 24-hour period). Runoff volumes controlled through the application of VC and WQv measures (Criteria #2 & 3, Tables 4.6 and 4.7) may be given credit towards meeting storage requirements. Discharges to cold-water fisheries should be limited to 12-hour detention. <ul style="list-style-type: none">▪ Sites less than 10 acres (or a site size deemed appropriate by the local program) shall use a combination of the mitigation techniques listed above and verify that stormwater measures provide 12 to 24 hour detention of the volume from post-development 1-year, 24-hour storm (again, allowing credits through the application of VC and WQV measures). A detailed downstream analysis is not required unless the local program identifies existing downstream conditions that warrant such an analysis.
Candidate BMPs to Meet Standards	<ul style="list-style-type: none">▪ Water quality swales▪ Grass swales▪ Level spreaders & energy dissipators▪ Riparian and flood plain restoration▪ Bioretention with extra volume of soil media▪ Pervious parking with underground storage▪ Outfall designs that use natural channel and velocity reduction features▪ Ponds and pond/wetland systems that provide peak flow control
Examples from Existing Programs – See Tool #5, Manual Builder, for more examples & links	<p><u>Stormwater Management Manual for Western Washington – Volumes I & V</u> http://www.ecy.wa.gov/programs/wq/stormwater/manual.html#How_to_Find_the_Stormwater_Manual_on_the</p> <p><u>North Carolina State University, Stormwater Engineering Group – Bioretention Design Spreadsheet</u> http://www.bae.ncsu.edu/stormwater/downloads.htm (system to assign detention credit to bioretention)</p> <p><u>North Central Texas Council of Governments – Integrated Stormwater Management Design (iSWMD™ for Site Development – Ch. 1., Stormwater Management System Planning & Design</u> http://iswm.nctcog.org/Documents/Site_Development_Manual.asp</p> <p><u>Henrico County, Virginia Environmental Program Manual -- Ch. 9, Minimum Design Standards, 9.01, Energy Dissipater</u> http://www.co.henrico.va.us/works/eesd/</p>